"SANITAS SANITATUM OMNIA SANITAS"

WHOLESOME HOUSES

BEING

AN EXPOSITION OF THE

BANNER SYSTEM OF SANITATION

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WHOLESOME HOUSES

THE SOCIETY OF ARTS ON THE HEALTH AND SEWAGE OF TOWNS.

The Executive Committee report . . . . "4. That, for use within the house, no system has been found in practice to take the place of the water-closet. 5. That, although there are appliances and arrangements by means of which the sewer-gases may be effectually prevented from entering houses, they still do so in the great majority of dwellings, both in town and country, including the metropolis. 6. That it is of the highest importance, in a sanitary point of view, that the metropolitan and local authorities should exercise great vigilance with respect to this matter, and that it should be made by law the duties of these bodies to enforce efficient measures for the exclusion of sewer-gases from dwellings, and to watch over their being efficiently carried out under such a system of payment as shall not press too heavily on those at whose charge the work is done."

(Signed by)
The Right Hon. James Stansfeld, M.P.,
Chairman of the Conference.
Lord Alfred Churchill.
Sir H. Cole, K.C.B.
Lieut.-Col. Sir E. F. Du Cane, R.E., K.C.B.
F. A. Abel, F.R.S.
General F. C. Cotton, R.E., C.S.I.
Capt. Douglas Galton, R.E., C.B., F.R.S.

Times, 9*th January*, 1873.

"I have, however, I am sorry to say, too much experience as to the absolute necessity of attention and alteration being required in the matter of Drains and Ventilation, even in the most recently constructed and costly mansions.

"Robert Rawlinson."

Times, 8*th April*, 1874.

"The word 'impossible' has ceased to exist in the vocabulary of the sanitary reformer: if a prevalent evil ought to be removed, it can be removed."

"SANITAS SANITATUM OMNIA SANITAS."

WHOLESOME HOUSES

BEING

AN EXPOSITION OF THE

BANNER SYSTEM

OF SANITATION

BY

EDWARD GREGSON BANNER, C.E.

TWENTY-FIFTH THOUSAND

Illustrated with Numerous Wood Engravings

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PREFACE.

In the following pages will be found a description of the new system of sanitation, and of certain sanitary appliances, with the opinions of numerous leading journals and eminent sanitarians concerning them.

With respect to the description, it is given in the briefest manner possible.

The opinions quoted are the outcome of careful observation and inspection by those who have given them.

In order to arrive at perfection of detail, as well as at a completely unbiassed judgment, the fullest criticism from persons capable of giving it has always been invited, and the results have been not only highly satisfactory, but also a gratifying and sufficient encouragement for a wider field of operation to be entered upon.

E. GREGSON BANNER, C.E.

11, Billiter Square, E.C.,
1*st Dec.*, 1877.

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WHOLESOME HOUSES.

BANNER'S SYSTEM OF SANITATION,

WHICH consists in effectual trapping, by a single trap to each house, and thorough ventilation, will be the better understood if the reader will bear in mind the following facts :—

The gas of which *a drain or sewer is always full cannot unassisted rise up a vertical shaft*, and the best agent to utilise in order to afford such assistance is the wind, which in this country blows at an average velocity of ten miles an hour or so all the year round.

It is well known that *liquid* will not flow out of a cask unless the vent peg, to admit air, is taken out, but it has hitherto escaped attention that to *withdraw air*, especially foul air, a mere outlet is not enough, and that in order to do so, and keep up a constant current of air, *some extracting power is also necessary* (as shown at Plates 1, 2, 3, and 7), even if the cask or tube or drain has two tubes inserted into it, and they be open at *both ends*. Therefore, it is now contended that, for thorough or true ventilation *mere inlets and outlets* are insufficient; because, as is also here contended, FOUL air or gases, *so* "vitiated," do not rise to the highest points, but diffuse themselves throughout

the area of the whole space, even though the *hottest* air, *so* "vitiated," does rise to the highest level in any room.

Some people profess to believe that, "in obedience to the never-failing law of Nature," *foul* gases must rise and give place to others, *because the latter are heavier*. This theory, in the majority of cases, is in reality a mere excuse for ignorance, or indifference to the great principles involved, and will certainly be admitted as untenable as soon as the law of *the diffusion of gases* is properly understood.

A rotten egg when first broken causes an intolerable stench. Soon after fresh air has passed through or over the shell it affords very little proof of its having contained putrescent matter; the same condition of purity is produced in the *soil-pipe* of any house by passing fresh air up it constantly, and nearly the same would be the result in the case of a sewer, or of a ship's hold, thoroughly ventilated on the *vacuum* principle of Banner's System of Sanitation.

When the terrible stagnation which at present exists in sewers and drains is prevented by better flushing and *thorough* ventilation, *dangerous gas* will cease to be generated and stored in *them*, but until then simpler means will not suffice to render our houses safe.

The Banner System of Sanitation, in its entirety, may be described thus:—A single trap suffices for the whole house, and only pure fresh air is allowed to remain in the soil-pipes or drains of a house for a single moment; while under the old system—that universally adopted *in* houses hitherto—there is a multiplicity of traps and other costly contrivances employed, which are not only useless, but dangerous, since the application of them results in the soil-pipes and drains being

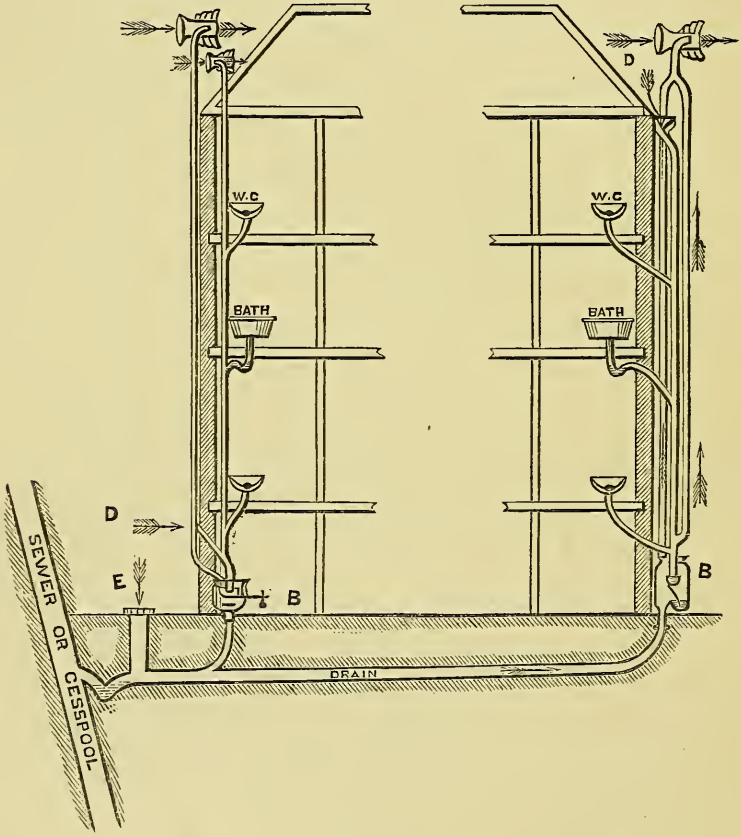
kept constantly "full to the brim of sewer gas" from year's end to year's end.

It is therefore hoped that the truth of the facts, as stated above, will force conviction upon unwilling minds, and satisfy even them, not only that the Banner System of Sanitation is the best and safest, but that the continuance of the old system cannot but be attended with the greatest danger.

A full and fair comparison of the two systems is fearlessly challenged, in the confident belief that it will result in the influence of the few whose pecuniary interest may possibly be affected by the necessary change, not being allowed to override common-sense, and by so doing perpetuate a state of things which will *still endanger not only the lives of more members of the Royal Family and of the nobility of the land, but continue to destroy and seriously affect, in many untold ways, yearly, hundreds of thousands of the community at large*—whether they live in the palaces of the Queen herself, or in the splendid mansions of the most wealthy everywhere, or in the poorest dwellings—by allowing houses still to remain, in the words of Mr. J. P. Seddon (page 50), "DEADLY FEVER-TRAPS, WHETHER THEY BE MANSIONS IN BELGRAVIA OR COTTAGES IN THE SUBURBS."

Such a statement as the foregoing would be most reprehensible if it were untrue, and it is only upon conviction that it is substantially and perfectly true that it is made.

Plate 1.



WHOLESOME HOUSES.

Plates 1 to 3 and 7

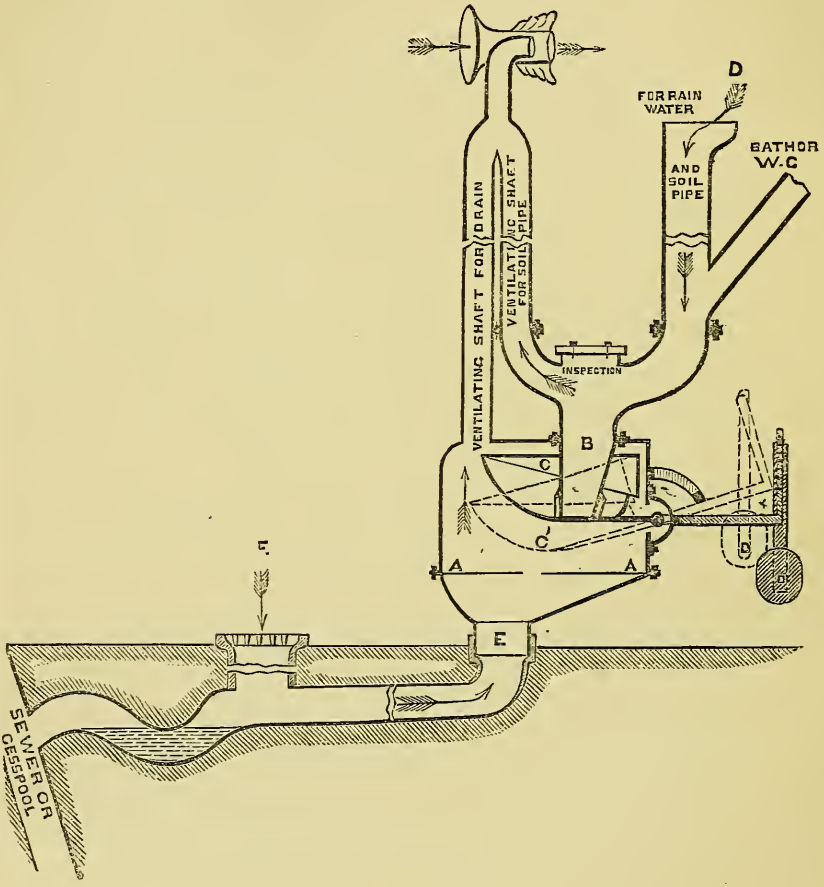
Represent the mode introduced by the patentee for *thoroughly ventilating the soil-pipe*, and the *house drain* by means of a separate shaft; the two being joined near the top, one cowl mounted thereon above the roof *can* then be made to suffice for both.

D is the inlet by which external air is led into the soil-pipe immediately above his Patent Drain Trap (B), thereby admitting, by the action of the patent cowl fixed on the top of the soil-pipe carried above the roof, of a constant current of fresh air throughout the whole system of soil-pipes of the house.

The "inlet" for fresh air to the soil-pipe a little above the trap on the basement may be by a short pipe for that express purpose, or the rain-water pipe from the roof may be employed. The "inlet" to the drain may be a rain-water pipe from the roof of the house or that of an adjoining building, or it may be through a grid to convey also surface water into the drain.

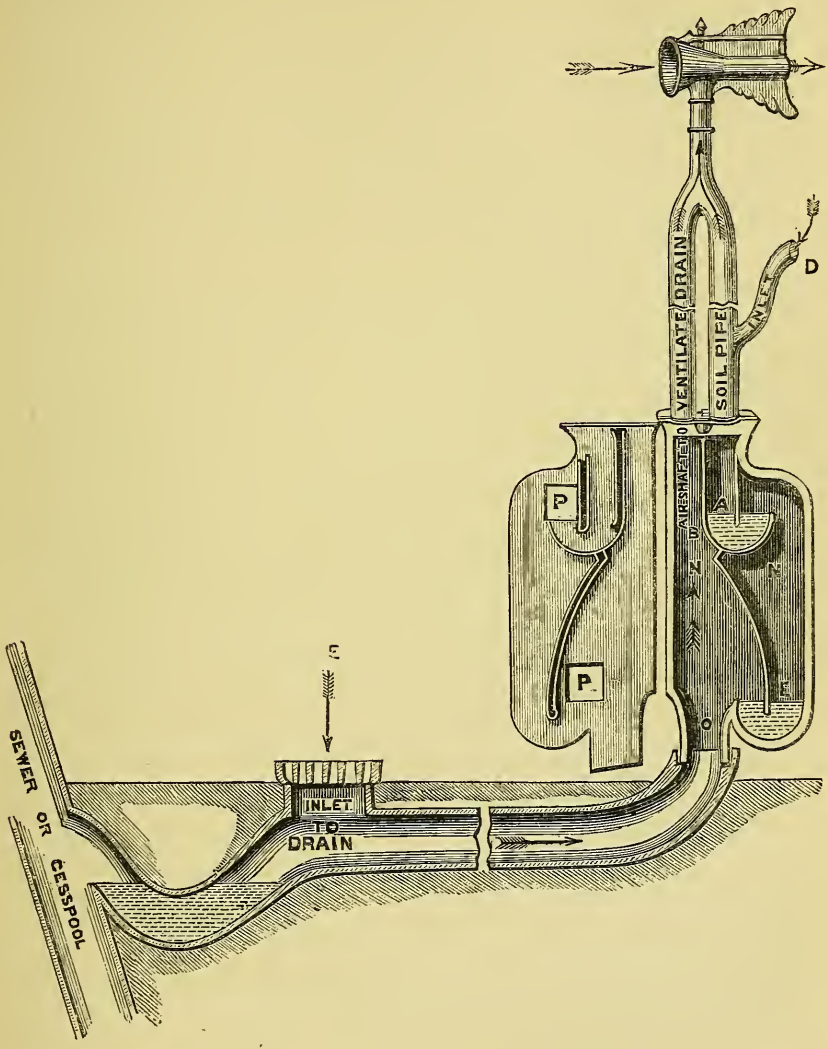
The conditions to be dealt with vary at different houses, and great care is therefore necessary in arranging the details so as to insure the thorough efficiency of the system.

Plate 2.



The above is the model introduced by the Lever-trap, patented 1st August, 1872, as exhibited at the International Exhibition in 1874, and afterwards at the Sanitary Exhibition at Glasgow in October, 1874.

Plate 3.



The above is a simpler mode of effecting the same object as shown in Plate 2. Patent dated 2nd July, 1875, No. 2401.

The gases formed in *the drain* will escape therefrom at *the lowest point*, viz. at the "ventilator" (so called) at the ground level, unless the cowl be used to make the "ventilator" always an "inlet." *From actual experience we are able to certify that with a 4-inch Banner Ventilating Cowl a constant current of fresh air can be made to course along a* HORIZONTAL *drain a distance of over one thousand feet while the sewage is passing down it in the opposite direction.*

E shows the same plan extended to *the sewer*, by means of which the present road or street "Ventilators," so called, would become *inlets*, whereby a constant current of fresh air would be created and, accelerated by the action of the patentee's cowl fixed on the top of a sufficient number of shafts or pipes carried up outside houses, would be constantly maintained throughout not only the house and street drains but the sewer itself, causing the whole to be always as pure, comparatively, as are the pipes *within the house* where the patentee's system is adopted to ventilate the *soil-pipe*. Rain water should be led direct from the roof through the sink or pavement trap so as to flush the house and street drains, instead of, as now, destroying the metal roads, stopping up the gullies with detritus, and at last silting up the main sewer itself.

As self-preservation is the first law of nature, everything in the way of Sanitary action ought not to be left to the Sanitary authority.

On the principle "Take care of the pence, the pounds will take care of themselves," if all the house drains were ventilated *outside* the houses, the sewers, which at present are dangerous, would become not only innocuous, but would cease to be inconvenient.

By the adoption of the same plan, vitiated air may be drawn from any room in a house or from the cabins, forecastle, or holds of ships.

BANNER'S PATENT SANITARY APPLIANCES.

From the *Sanitary Record* of 30th Oct., 1875.

In point of value as a sanitary invention, the patent trap and foul air withdrawing cowl of Mr. Banner, of Brighton and London, were the gems of the exhibition. We say this advisedly, for if there are two contrivances more than any others in the way of sanitation that have puzzled our inventors, the house trap and the drain ventilator are those two. The trap invented by Mr. Banner has been several times referred to in our pages, and a description of it attempted, but without woodcuts it is quite impossible to do justice to it. We shall shortly be placed in a position to illustrate this trap with its last improvements, and also the cowl, for use upon the ventilating pipe in connection with the drain. Meanwhile we will venture to say that Mr. Banner's system of trapping is a sound one, inasmuch as one trap suffices for the whole house. And we know his method of ventilation is a good one, because he introduces a current of air into the foul-air pipe, and the cowl perpetually draws it out. *He also showed by experiment that without an inlet of air into the ventilating pipe, no cowl will work as a foul-air extractor.*

Major Seddon, R.E., in his report in *The Architect* on the general applicability of these appliances, and upon the excellency of the Banner System of Sanitation in its entirety, concludes his remarks in these very flattering words:—

I must say, in justice to Mr. Banner, that the greatest possible credit is due to him for having succeeded in solving a problem which has hitherto baffled all the combined talent of the best sanitary authorities of the day.

Mr. J. P. Seddon very fully endorses and confirms Major Seddon's report (page 41), and adds :—

The first thing that Mr. Banner showed us was, by experiment upon a small scale, that a pipe open at the top, charged with the noxious gases, which are heavier than the atmosphere, remained so charged—that is, full to the brim, notwithstanding all efforts to disturb by blowing down the pipe (as wind might be supposed to do), until an aperture at the bottom of the pipe, to allow of the admission of air, was opened, *and an extracting force applied at the top* by means of one of his patent cowls, to be hereafter described. Then instantly, but not till then, was the pipe emptied of its contents, which represented the foul air in a soil-pipe, and a current of fresh air *upwards* maintained through the pipe.

We next proceeded to inspect the patent trap, which was fixed in a cupboard in the basement, and resembled in size and appearance an ordinary gas-meter. The description of this trap had appeared to us complicated, and as such to present weak points, but when its handy position, and facility for inspection, and the ease with which it could be got at, cleansed, and repaired, if necessary, were taken into consideration, these fears seemed to be unwarranted, and of its efficiency in securing a perfect seal, under all circumstances of its action, we were speedily convinced.

We took some trouble to test the trap by throwing cloths, corks, &c., down the closets and watching its action under these circumstances. The cloths disappeared bodily, with a swiftness that almost escaped our vigilance.

We then went to inspect the outlet of the ventilating pipe which brought fresh air to the bottom of the soil-pipe, just above the trap.

This certainly proved to demonstration the satisfactory working of the current of air kept up between the ventilating pipe and this cowl, in preventing the slightest accumulation of foul air or gas in the pipes.

We then went to examine the cowl itself. *Without doubt, the cowl is an admirable one, and may be applied to many other purposes besides the one under consideration, with great advantage,* as for instance, to the exhausting ventilating pipes Mr. Banner proposes for house ventilation.

To sum up the result of our examination into these sanitary ap-

pliances connected with house drainage, *I would say that, in my opinion, Mr. Banner's system is, under existing circumstances, an excellent one to adopt in houses and buildings of any pretension.* Its first cost, which is not great, may be considered as to a great extent compensated for by the facility it gives for inspection and repairs, *which, with the ordinary appliances, all hidden out of sight, are such a constant source of annoyance and expense to householders and of profit to plumbers, who would be more than human if they did not constitute them a means of obtaining an income to themselves.*

The first cost, however, is capable of considerable reduction, and Mr. Banner has now in hand the construction of a much simpler trap (since perfected), which he believes would perform the same object as the one above described. *The system permits of the complete abandonment of the abominable* D *Trap, and indeed of all other traps* in connection with the closet apparatus itself. *This is obviously a great saving in cost which would go far towards defraying that of the main trap in the basement, which is the only one wanted.*

Extract from the Annual Report of R. P. B. Taaffe, Esq., M.D., M.S., Lond., Medical Officer of Health for Brighton:—

Let me sketch what I consider would be a perfect scheme for the prevention of the ingress of sewer gas into houses. The closet to be without a D trap. The *soil-pipe* to have a 2½-inch ventilator to the top of the house. At the bottom of the soil-pipe a Banner's drain trap. A 4-inch ventilator from the *house drain* to the top of the house; this ventilator, and also that of the soil-pipe, should run up some feet above the parapet, and each be covered with a Banner's ventilating cowl. *The adoption of the above scheme would, I feel quite certain, render any house perfectly secure against the ingress of foul gas from drains or closets.*

Extract from a letter from the author of "Healthy Houses," "Sanitary Arrangements for Dwellings," &c.:—

10*th May*, 1875.

The conclusions I have come to after a considerable time spent upon their study is that they are the best *media* out for the work which they are intended to compass, that I can confidently recommend them, and that they ought to be specified by architects generally.

BANNER'S PATENT DRAIN TRAP.

PLATE 4.

IT is found impossible, *with the ordinary forms of traps in use,* to prevent the inflow of gas from the sewer into the house.

Banner's Patent Drain Trap effects that most important object. *It is entirely self-acting and always perfectly air-tight;* it *flushes clean and cannot be unsyphoned.* The arrangement is novel and effectually prevents *at all times* the escape of sewer gas into the house, while it dispenses with the ordinary forms of D and other traps used in connection with water-closets, the universally acknowledged inefficient action of which is a constant source of danger. The very construction of D traps prevents a clearance of soil from them ever being effected, and they therefore become generators of impure gas, which is freely admitted through the "container" into the house each time the closet is used, and the gas from the sewer is also constantly *drawn* through them and through faulty pipes *into the house,* by the varying temperature of the latter, which is facilitated by the syphon action of one closet upon another when there are more than one in the house. D traps, again, often become "choked" by foreign

Plate 4.

Fig. 1.

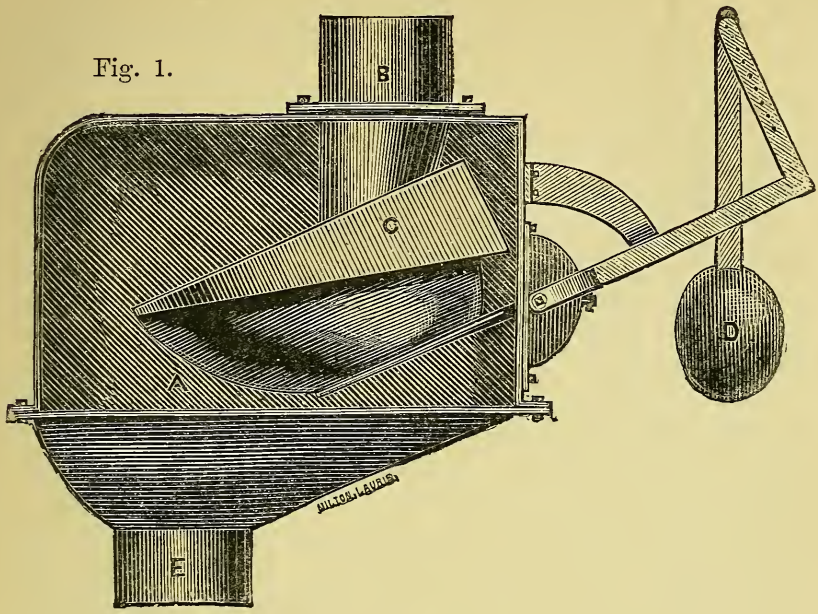
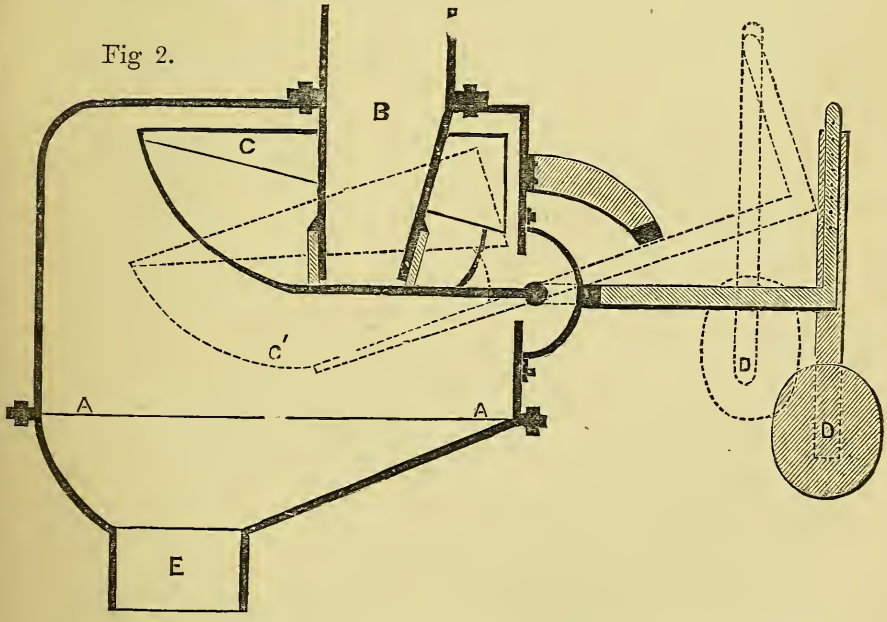


Fig 2.



The patent for the above trap is dated August 1, 1872, No. 2303, and is the first patent by which the "inlets" are secured, as shown in the arrangements at Plates 1, 2, 3 and 7, and without which no cowl will act.

substances, such as hair, cork, &c., passing into them, and as the closet must be taken down before the D trap can be got at, a plumber has to be employed, and great expense is consequently incurred before the obstruction thus created can be removed.

In a multitude of counsellors there may be wisdom, but in a multitude of traps within any house there is absolute danger, for it is now admitted that with soil-pipes carried above the roof, and merely left open at the top, the whole system of closets, traps, and soil-pipes within every house remains, as already stated, constantly full of sewer gas from one year's end to another, and while the first cost of so many traps is very great, the frequent expense incurred in trying to keep them in order is even still greater.

The inlets by means of which sewer gas may find its way into a house are very numerous. Dr. Carpenter mentions the following :—

1. It may find admission through the trap of the water-closet *when no ventilation* has been provided for the soil-pipe of the closet itself.

2. It may enter through defective joints or fissures in the soil-pipe, such defects being the result of bad workmanship, of accident, or decay.

3. Through any pipe which is in direct communication with the sewer which is for the purpose of conveying away waste of any kind, such as housemaid's sinks, butler's pantry sinks, and baths, which communicate direct with the sewer.

4. Through any pipe which is used as an overflow from wash-basins, baths, cisterns, etc.

5. Through the catch water tray which is placed beneath the water-closet in all expensive water-closets.

6. Through rain-water pipes communicating *direct* with the sewer, when *they open in enclosed positions* or *near to open windows.*

7. Catch-water drains, which generally exist in cellars and

areas under cover, and which are supposed to be trapped by a bell trap.

Most of the connections enumerated are *supposed* to be trapped by some modification of *a syphon. We believe that syphons are liable to be delusions and snares for entrapping the unwary.* Any one may prove this for himself by watching a glass syphon, similar to an ordinary syphon trap when put into action, and then thrown out by cessation of function for want of water. The long leg of the tube sucks the short leg dry, and untraps the bend. It follows from this that *all traps which depend for efficiency upon a syphon action* are *practically useless.* If their function has been brought into play for the prevention of an overflow, when the overflow ceases the trap is at once untrapped by the long leg of the syphon itself, whilst it is also as certain that if the function has not been exercised, the water which was put into the trap has evaporated and *left a clear channel for the conveyance of air into the house without let or hindrance.* It must follow, therefore, that traps which depend for efficiency upon water being always present in the trap will fail *unless a provision is made for the arrest of the syphon action. This provision is the exception which is seldom present. Not one in ten thousand contain the required protective action, and syphon traps without it are worse than useless.*

A well-known writer on the same subject says—

It may, perhaps, interest your readers to know that the results of the experiments as to *the passage of sewer gas through water traps,* which Dr. Fergus refers to in his admirable paper of last week, are *fully borne out by practical experience.*

The true and only remedy for the defects pointed out by Dr. Fergus is to remove their cause—viz. *improper construction;* and the water-carriage system can be made as perfect as the strictest sanitarian can desire.

The principle of disconnection has long been applied to the waste-pipes of sinks, baths, overflows, &c., but *until recently it has been* the usual practice to consider the principle as *inapplicable to the soil-pipes from water-closets.* This is, however, quite a mistake, *as with suitable arrangements* soil-pipes as well as waste-pipes can either be *absolutely disconnected,* or *ventilated in such a manner as to be virtually disconnected.*

By the employment of the improved trap, shown

in the engraving, all these evils are entirely obviated, for neither pressure, suction, nor syphon action can affect it; and one trap fixed like a gas meter inside or outside the house, in any convenient place in the basement, is sufficient for a house containing several closets, and can be readily adapted to existing houses.

The lever trap consists of a small air-tight chamber (A) of cast-iron, or other material, fitted with a 4-inch inlet pipe (B), which projects several inches into its interior; the lower end of this inlet, surrounded by an india-rubber band, sprung on and slightly projecting beyond the end of the pipe, is closed and made air-tight by a copper cup (C), of peculiar form, which is pressed up to it by a suitable *weight* (D) mounted upon a lever fulcrumed on an air-tight centre, and having its outer end bent upwards at a right angle. The *weight* is suspended by a link on the raised end of the lever, and is so arranged that when the pan is in the act of tilting (C^1), the centre of gravity of *the weight* (D^1) is brought nearer the fulcrum, thus reducing the load and allowing the pan (C^1) to remain tilted, without at any time unsealing the trap, till it is thoroughly flushed, yet retaining sufficient power to completely close the trap again after flushing. A series of holes in the raised end of the lever permits of a proper adjustment of the *weight*, and a bend in the soil-pipe, just above the trap, breaks the force of the water reaching the latter from above. The lower part of the chamber (E) is formed with sloping sides, terminating in an outlet in connection with the drain.

Before flushing, the cup, when full, weighs *over* 15 lbs., while the utmost weight opposed to it on the lever is *less* than 15 lbs.

After flushing, the cup and clean water left in it weigh *under* 7 lbs., while the weight on the lever after flushing is *over* 7 lbs.

The column of water in the soil-pipe (B) cannot rise more than 12 inches *above the chamber*, but the weight on the end of the lever is sufficient to maintain *in the soil-pipe* a permanent column of several inches of fresh overflow water, besides the clean water left in the bottom of the cup after each thorough flushing, till the closet is again used and its contents are discharged into the drain, when the copper pan filling again is again tilted, and remains down sufficiently long to admit of a thorough flushing (*but at no time unsealing the end of the inlet-pipe, as will be seen from the dotted lines in the engraving, which shows the pan in its tilted position*), after which the trap is brought back by the action of the weighted lever to its normal position, when, besides the air-tight valve thus formed, there is a water seal of three inches in the cup, and several inches up the soil-pipe.

A small piece of pipe from outside the house to a little *above the trap* may be safely and advantageously used to lead external air into the soil-pipe, and thus there will be established a constant current of fresh air throughout all the pipes *between the trap and the cowl fixed on the soil-pipe carried above the roof of the house.*

A separate pipe may, if thought desirable, be fixed *into the chamber*, and taken up above the roof of the house, *to ventilate the sewer or the drain.*

This is a most advantageous form of trap for all low-lying districts, where there is danger, in times of flood or high water, of the drains returning their contents

into the basements, as the greater the pressure of the returning sewage matter towards the chamber below the trap, the more tightly is the copper pan closed against the end of the soil-pipe inlet, so that no flood-water, sewage, or sewer gas can possibly be forced past it into the basement or any other part of the house; *a desideratum which cannot be obtained by any other trap.*

The outer end of the lever being exposed to view, in the event of any foreign substance causing a stoppage, it can be readily remedied by a domestic in two or three very simple ways.

Fig. 2, in Plate 4, shows the Cup Valve in the position it takes while flushing, when the opening is increased from the diameter of the inlet pipe above it, to 12 inches.

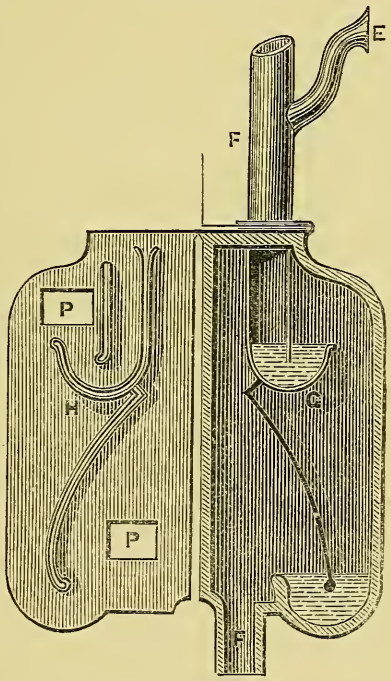
The apparatus can, if more convenient, be fixed *in the place* of an ordinary D trap, immediately under the "Container" of a closet, and in such case the inlet pipe for fresh air (D) Plate 1, can be led directly into the "Container."

The outlet from each closet is so arranged, without being trapped, that whatever can pass through it will freely pass through the patent trap in the basement.

Plate 5 is a diagram of another house drain trap patented by Mr. Banner, July 2, 1875, No. 2401; while it is less expensive, having no movable parts, it is nevertheless equally as effective as his patent lever trap for the complete exclusion of sewer gas from the house. Its great advantages over the ordinary syphon or dip trap are manifold and apparent; like the lever traps already described, it is self-acting, always air-tight, flushes clean, and cannot be unsyphoned by any action whatever of the sewer or otherwise; it may be used

to ventilate the soil-pipe only, or the sewer or cesspool also; or, if preferred, only the soil-pipe and house drain, by a pipe of any desired diameter led from it, outside or inside the house, to above the roof and having a cowl mounted thereon. One trap in the basement, inside or outside the house, will suffice for

PLATE 5.



E—Inlet air pipe.
F—Soil pipe.
C—Double dip trap.
H—Outer plate of trap reversed.
P—Inspection plates or screw caps.

any number of closets, and placed in any cupboard or recess, or against the wall, only occupies a distance therefrom of five inches, while there is a vertical fall of *two feet* between the two dips. The space between them, which is always air-tight, would hold, if it

could be filled with water, over two gallons, the weight of which alone would then exercise a downward force of over 20 lbs. on the lower dip, while the fall of water from the upper closets, often as much as 40 or 50 feet, will always keep the upper "dip" completely free from any possibility of the slightest impurity ever remaining in it for a moment, precisely as in the case of the lever trap. The trap is larger than the soil-pipe to be carried up from it; the soil-pipe may be curved a little just above the trap if desired, which, however, is wholly unnecessary, as the *direct* action of the water falling from above into the first dip insures its being kept thoroughly clean at all times. The admitted extreme weakness of ordinary syphon traps is not only their great liability to be unsyphoned by the least suction action of the sewer, as well as in many other ways, but where they *can* be placed outside houses, for which there is no convenience in the small close areas of town houses, provision has necessarily to be made for frequently cleansing them in consequence of their great liability to become foul, owing to the greatly diminished force with which the water, &c., from the closets, however high above, dribbles into them after passing a great length of drain pipe, often under the floor of the house, *horizontally* for some distance before the syphon trap—probably situated under an *open grating in an area*—is reached. Many other inconvenient and otherwise serious objections to this mode of trapping are too apparent to need further mention here. One very serious one is forcibly pointed out in the earlier part of this pamphlet, which shows that the sewer gas is often forced by the action of the sewer itself through the water in such traps. As

has been clearly shown by Dr. Fergus, of Glasgow, foul matter is retained in ordinary traps, and consequent decomposition goes on. The inlet, *as introduced by the patentee,* to convey external air to the foot of the soil-pipe just above the trap, and which may be used without or in conjunction with a ventilating cowl or ventilator above the roof, for the purpose of establishing a constant current of fresh air throughout the whole of the pipes inside or outside the house, is admitted by all who can speak authoritatively upon such a matter to be a point of importance and value, constituting a great stride in sanitary science. It needs no charcoal tray or other nonsensical contrivance, such as is found necessary for ordinary syphon traps, to *prevent the escape* of poisonous sewer gas at the ground level when they are placed in areas outside houses, *as by the action of the cowl above the roof, the "inlet" in this system is always really an inlet for fresh air and never an outlet for sewage gas.*

The very great advantage of a foul-air withdrawing cowl being mounted on the soil-pipe above the roof is, that it insures *at all times* a current of fresh air *up* the soil-pipe, while without it the wind would blow down any pipe open at the top, and then the most poisonous sewer gas which passes the water in an ordinary trap or "disconnection" would be forced out at the *intended* inlet, to the great danger of persons on the basement floor, or at open windows, *as at present.*

This most important fact must never be lost sight of —GAS *from a sewer or drain* CANNOT, UNASSISTED, RISE UP A VERTICAL SHAFT.

BANNER'S

PATENT VENTILATING COWL, OR HORIZONTAL VENTILATOR.

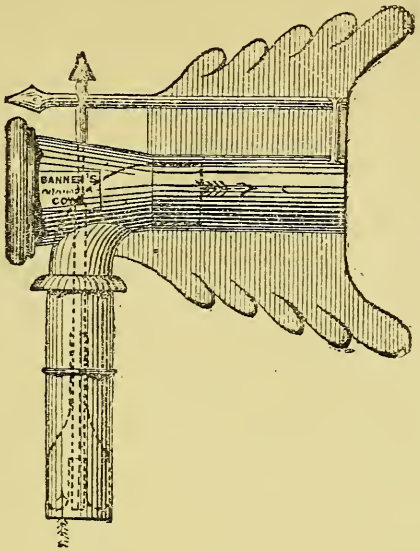
The patent for this cowl is dated October 5, 1874, No. 3400.

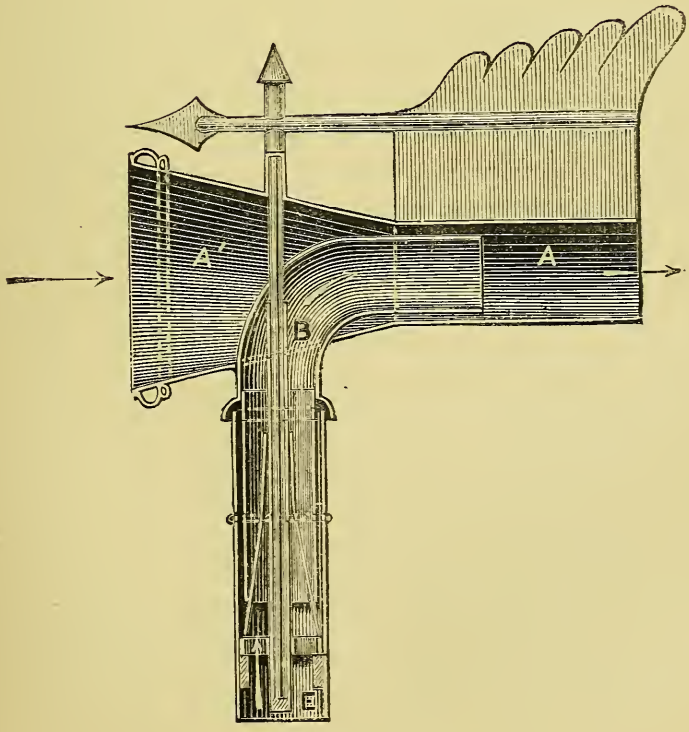
The small sizes were specially designed for soil-pipes and drains, and used with the trap with "inlet" patented, as already stated, on the 1st of August, 1872, No. 2303, would alone be useful, as without such "inlet" no cowl can be of any use.

The public are cautioned against the use of weak or specious imitations of the original Banner Cowl. None are genuine unless they have on a brass label affixed to them "Banner's Patent Ventilating Cowl," each of them being numbered.

This novel apparatus supplies the want of the age, and should be used universally; it is inexpensive, and, though it is simple in construction, its action is so important and effectual that no house having a water-closet in it should be without one fixed on the soil-pipe carried above the roof; as well as one on a pipe led from the drain to ventilate it. It will be found most useful in many other ways, to draw off vitiated air from heated rooms in public buildings, banks, offices, schools, stables, granaries, warehouses, ships' holds in which the cargoes, alive or otherwise, are liable to become over-heated, and the cabins or forecastles of vessels;

PLATE 6.





also smoke and heated air from railway carriages, &c., and smoke from chimneys; and it effectually prevents any down draught.

The great use of this Cowl is not only to *draw off* foul air and prevent down draught at all times, *but especially to do both when most needed;* viz. during high winds or gales when, without it, all the mere outlets in the shafts above the roof become closed, owing to the greater external pressure of the wind, which not only prevents the foul air escaping at such outlets then, but, by causing increased pressure from all points within the sewer and street drains, forces the gas *thus locked into them,* through defective traps, *into the houses.*

Its action is as follows (see Plate 6): The larger end of a funnel-shaped tube (A[1]), placed horizontally, is always directed towards the wind, and a current of air passing in there, is pressed forward through the annular space between the two cylinders (A, B), and when it reaches the end of the inner one (B) it expands all round it, and in its passage out at the smaller end of (A, A) a vacuum is created round *the point* of the inner cylinder (B), which by suction *draws out* its contents into the open air, and thus induces an upward current of air from the shaft or pipe leading from the place to be ventilated.

To be effectual an inlet for admission of fresh air into the soil-pipe, a little above the trap on the basement, is indispensable; and the annular space between the tubes of the Cowl itself, as well as in the lengths of the latter, must be in certain proportion to their sizes.

By the adoption of this simple apparatus in conjunction with Arnott's ventilators, a most beneficial effect is obtained.

LETTER ON SEWER GAS AND D TRAPS.

To the Editor of the *Sanitary Record*.

Sir,—The use of D traps under each closet should be entirely forbidden by legislative enactment.

It is generally represented that a trap should be placed as near to the closet as possible; but now that a good supply of water is obtainable, it may at least be doubted whether the good a D trap is supposed to do is not greatly overborne by the positive harm it does. That dangerous receptacle, called a D trap, is always placed under every closet, in some form or other. In addition to always being itself virtually full of most impure matter, generating foul and often poisonous gas, which every time the closet is used rushes into the house, it also affords free access for gas to pass direct from the sewer into the house, to the great danger of the inmates; for where there is more than one closet in the house, or where, besides the one closet, there is a bath in the house, the D trap is constantly rendered ineffectual *through an inch or so of the water in it* being by syphon action pumped or drawn out, at the same time that the "trap" in basement, by the syphon action of the sewer upon it, has been in its turn rendered ineffectual as a trap.

Dr. Alfred Carpenter, in a very able paper which appeared in No. 12 of the *Sanitary Record*, says:—

"The air contained in an upright soil-pipe must get into an unsafe state for people to inhale, if it is allowed to find its way into sleeping, or indeed into any inhabited rooms. This has now become an established axiom of sanitary science. The air in soil-pipes must be stagnant for many hours together if no means are taken to ventilate them, and when used every gallon of water which passes down must displace a nearly equal volume of air, which will necessarily find its way either through the trap or through some of the junctions, into the water-closet, and thence into the house."

D traps are always full of soil; no rush of water can be had to flush them; for though the cistern for the closet may be fifty feet above it, as the water falls first into the basin and then into the "containers," its real fall for flushing the D trap is only an inch or two; thus it only dribbles down into the D trap, and in like fashion dribbles out of it, *leaving the soil in it.* Most unquestionably these D traps generate foul gas, which must rush into the room every time the closet is used, and the larger the D trap the greater the danger; for, besides the foul gas which is forced up from it every time water passes down, I am told the plumbers, to prevent syphoning in some slight degree, often perforate the top side of the D traps, and thus make an outlet for the gas from it and from the sewer always into the house. I have long done away with D traps in my house, and with the most satisfactory results; and I hope, before very long, it will be generally admitted that they are chief offenders in every house, though, as yet, they are left, often I fear, to do deadly work silently and unseen; for in the language of the *Times* lately, in its article on the untimely death of Dr. Anstie:—

"*Sewage stagnating in an* IMPERFECTLY CLOSED *cesspool is sure to be a source of noxious gases, and it is difficult to conceive how such a violation can ever have been tolerated.*"

I am surprised at the absence of severe remarks from Dr. Carpenter upon this chief defect of the present system of house-sanitation, viz. the D trap, but the strong opinion which he so ably expresses seems to fully confirm the belief that, under existing arrangements, the sewers are ventilated generally, through the D trap and soil-pipes, and other defective traps and joints, *inside the house.* While, however, Dr. Carpenter is no doubt perfectly right in the principle he advocates—that both soil-pipes and sewers should be ventilated, I venture to express a belief that the plan he advocates, viz. of ventilating the sewers *through the houses by* "10,000 openings in soil-pipes," would be attended with great danger to the inmates, for several very weighty reasons.

He shows, by his suggesting these 10,000 *soil-pipe openings as ventilators for the sewer, that the "traps" or "disconnections" between the house and the sewer do not answer their intended purpose,* for if they were really traps, then the 10,000 soil-pipe openings could not ventilate the sewer, but only the D traps and pipes of the closet between the roof and the basement of the house; it will, nevertheless, be admitted if the soil-pipe openings only ventilate these latter, that by that alone they perform a most important purpose, and certainly would lessen the probability of syphon action within the house.

I submit that it is dangerous to allow the gas from the sewer *to pass up the soil-pipe,* because, from various causes, it will be likely to escape, or to be drawn into

the rooms of the house; *yet it seems clear that it would be most advantageous that the sewers should be ventilated at* "10,000 openings into them," *by a separate pipe for that sole purpose,* being led from a real trap in the basement to above the roof of each house; *such pipes being fitted with cowls,* which *will draw the foul air out of the sewers, and thus cause the "ground" ventilators to supply fresh air to the sewer, instead of foul air from the sewer passing out of them.*

As is suggested by Mr. Thomas Reid in the *Sanitary Record* of 19th ultimo, "*ventilators carried above the roofs of buildings should be for the discharge of sewer gas,* and *not* for the *supply* of fresh *air.*" And by Dr. Carpenter in the same paper, "The principle to be kept in view is that there shall be a sufficient number in the periphery of the system which shall promote a movement from below upwards; make openings enough, and danger is dispersed, or rather does not come at all. *A continuous current carries away the sewer gases before they are concentrated enough to do harm.*"

E. Gregson Banner.

October 5th, 1874.

In a long letter recently published in the *Architect,* one of the correspondents of that journal, speaking of the Banner System of House Sanitation, "*a system at once so simple yet so effective,*" thus describes it:—

"It is a tri-partite system, consisting of, first, 'the trap;' secondly, 'the inlet pipe;' and, thirdly, 'the cowl.' The first unit herein is based upon one of the simplest principles—and one of the oldest known to us—that of the steel-yards; the second is something entirely new, when applied to the ventilation of drains or soil-pipes. I say entirely new, because I

hear and read that other sanitarians are claiming this innovation as something well known before. I go further, and say advisedly, it has never been applied in practice for the purposes to which the patentee has adopted it, nor was it seen before it was introduced to public notice at the patentee's house at Brighton, during the Social Science Congress meeting there. Mr. Banner has very wisely secured it by patent, for without this inlet his cowl, or any other cowl, would be perfectly useless; the inlet being the lungs of the pipe or system, and the cowl the breathing power. This also illustrates another simple principle—the vent-peg in the barrel.

BANNER'S COWL FOR WITHDRAWING FOUL AIR.

(From the *Sanitary Record*, 15th of May, 1875.)

Hitherto in the matter of simple ventilation, the great difficulty has been to light upon some ventilating medium which should absolutely remove all the contaminated air, and that steadily and in no intermittent fashion, as is the case with many highly-lauded ventilators, which, however, are biassed in their action by the prevailing wind. It has been usual, even in the case of the top of a soil-pipe, to be content with a common funnel top, or a Tredgold pattern cap, but neither of these devices *withdraw* the foul air generated in the drains, but allow it simply to *escape* at *times*, more especially during *lulls* in the weather. The open-mouth revolving cowls are an improvement upon these latter contrivances, but still these behave far from satisfactorily, as the levitation of the gases is not mechanically assisted. *They are allowed sluggishly to accumulate in the ventilating tube* until the outer air permits them to find an exit. To remedy such evils Archimedean screw ventilators have been invented, and they perform excellent work in many situations, for instance, in cotton or woollen manufactories, where the withdrawal of the fluff in the air is desirable. And many other species of air regenerators have been tried with more or less success for these and kindred evils.

The difficulty, however, has been to provide a simple ventilator which, without unnecessarily forcing a change of air in a room and so creating a draught, should still readily act in quietly removing the stratum of air which has become unfit for

respiration, and enable the room to be quickly filled with fresh air through the inlets provided for that purpose. The same beneficent result ought, of course, to follow its application to sewers and drains, and even vessels at sea. All that ought to be done by the workman should be merely affixing upon the top of the shaft the peculiar pattern of cowl which is the best adapted for the purposes sought, and the wind ought to carry out the rest of the contract. It is sufficient to say that a really effectual ventilating cowl would work equally well, whether withdrawing the air which passes up the soil-pipe of a closet, pumping up the air from a general trap in the basement of a house, or retiring upon a larger scale the gases evolved by a main sewer; in the first case by dissipating the foul air through a four-inch pipe, in the second, it may be, by a six-inch pipe, and in the last-mentioned case by perhaps a shaft of two feet sectional area.

The principle of Mr. Banner's cowl or foul-air withdrawer, and which is specially adapted for places such as we have described, is as follows. A revolving cowl is fitted upon the top of a foul-air shaft, and this is pierced both at back and front, the end best adapted for exit being always held to the direct current of air. The foul air naturally rises up the shaft, and from the simple blow-pipe action would at most times escape from the mouth of the vane, because the wind would be blowing through the aperture at the back and assisting in its removal. But Mr. Banner has not been content with this idea of an occasional suctional action across the shaft, but has contrived a means of continuously extracting it under all the varying influences of wind and weather. *By means of this cheaply made and otherwise simple apparatus, the foul air in any shaft will be continuously extracted.* The invention is also adapted for use in churches or schools where a shaft would not be needed, but merely an opening at the ridge.

Professional gentlemen who have to deal with sanitary questions have long been in search of a ventilator which could really be relied upon to perform, uninterruptedly, useful work under the circumstances which we have already enumerated; and we esteem it a fortunate thing for them, and, of course, for ourselves and the public generally, that it will, in future, only be necessary to specify the cowl now before us. The inventor, Mr. E. G. Banner, of Billiter Square, London, is well known to sanitary men as the inventor of what we cannot help terming

the best devised house-trap in existence, and to the history and working of which it is our intention to refer on an early occasion. Meantime let our readers who require foul-air withdrawers—as we have most uneuphemistically called them—try the Banner cowl. We have no doubt that in a very short time the name will be familiar in our mouths, and that the inventor—whom we understand, by the way, to have taken up the subject of sanitation on public grounds, and outside his own avocation—will do as much or more for health as Moore has done with glass *louvres*, Cooper with revolving panes, or the Boyles with mica flaps, and ridge, vane, and turret ventilators.

In a paper read before the Social Science Congress at Glasgow, in October, 1874, Dr. Fergus said:—

All sanitarians are agreed as to the necessity of trapping drains, and many contrivances have been adopted in order to do so. We may explain that a trap is a body of water interposed between the sewers and the pipes leading into our houses to prevent the entrance of sewer-gas through these pipes, and generally supposed sufficient to do so. A very common form of these is what may be termed the tongue trap, and it acts most effectually in *preventing the entrance of vermin into houses*. I may be allowed to state, that to ventilate the sewers is quite as important as to trap them, but let us pause a moment to inquire whether we are using a proper term. *The term "ventilation," I should suppose, means the replacing of foul air by fresh air, of which the various plans proposed certainly fall short.* They do, indeed, provide for the escape of a certain portion of foul air from the sewer into the open air—*not, however, to be replaced by fresh air, but by equally foul air, from the decomposition going on in the sewer.*

I must not be supposed as undervaluing the sanitary advantage of the removal of foul air from the sewers; indeed, ventilation strictly so called hardly exists.

Formerly I did believe in the ventilation of sewers. This was quite a cherished idea, and I abandoned it with great reluctance; but experience, observation, and reflection compelled me to do so. My impression is that the following *is* the process going on

without much cessation, viz. *the sewer air is absorbed by the water in the sewer side of the trap and discharged in the house end of it.* I have not hastily arrived at this conclusion; it has been forced on me as the only solution of all the facts of the case—the passage of sewer air *through the water in the trap.* We ought to take a broader view of the question, and feel that this gigantic evil *must* be got rid of.

PATENT DRAIN TRAP AND FOUL AIR EXTRACTOR.

(From the *Builder* of December 11th, 1875.)

In the course of our remarks on the recent exhibition of Sanitary Appliances in Brighton, we alluded briefly to the trap and ventilating cowl invented by Mr. Banner. The subject, however, is so important that we think it desirable to enable those who are interested in the matter to understand more fully the patentee's views, and to judge for themselves as to their soundness.

The patentee maintains, the house will always be effectually trapped against sewer gas; and he is able to dispense with D traps, which from their conformation are, in point of fact, miniature cesspools. One of Banner's traps at the basement of the house, which may be placed above the level of the basement, like a gas meter, is considered sufficient for all the closets in a house.

We must not omit to mention another valuable appliance devised by Mr. Banner. Every one knows that ventilating-*shafts* communicating with the soil-pipes are recommended by leading authorities upon the subject. Although the theory upon which they are constructed is good, they are not always of practical utility. There is a difficulty in getting sewer gas to ascend a long perpendicular pipe, *while in some conditions of the atmosphere there may be a down-draught instead of an upward current;* and it is to overcome this that the cowl is introduced. The benefit that would result to the community from their general adoption would probably be great, as each would contribute to the ventilation of the sewers as well as of the pipes of the houses where they were fixed.

A branch pipe, led from outside the house to a little above the

trap, is needed, to cause a current of air in, and thus act as a constant ventilator of all the pipes between the trap and the cowl fixed on the soil-pipe carried above the roof of the house. A separate pipe may, if thought desirable, be fixed into the chamber, and taken up above the roof of the house, to ventilate the sewer.

These various arrangements have been in operation for two years in the patentee's house, and, as we are informed, and are prepared to believe, with undeviating good effect.

One lesson which Mr. Banner has learnt, and in his turn teaches the public, namely, that to make a ventilating pipe of constant avail air must be introduced at the bottom, is of itself a boon of value.

BANNER'S SYSTEM OF SANITATION.

(From the *Architect* of 20th November, 1875.)

Notes on Novelties.

We have recently had an opportunity of thoroughly investigating the action of the sanitary appliances that have been patented by Mr. E. G. Banner, of 11, Billiter Square, E.C. The system adopted by Mr. Banner completely shuts out the sewer gas from the house, and is used *outside the house* to withdraw the gas from the drains and the sewer itself, and disperse it in the upper atmosphere, far above the height at which it could possibly be injurious to human life. Mr. Banner's invention not only prevents all sewer gas from entering the house, but it also removes immediately the effluvia from the closets, and at the same time is made to thoroughly ventilate the whole of the pipes from the basement to the attics. We have no doubt that some sanitary reformers on reading the above statement will declare that such a result as we have described is impossible. Our answer to such objectors is—do as we have done, investigate and judge for yourselves. The illustration (see Plate 1) will give some idea of the manner in which the novel plan introduced by Mr. Banner is effectually carried out. It will be seen that the system commences at the very bottom of the house, where the outlet to the sewer is thoroughly trapped, and that all other

traps which are generally fixed to closets, bath, &c., can be dispensed with. The trap employed is entirely self-acting, and is always perfectly air-tight, the method of its construction proves that the flush must be complete under all circumstances, and it can be seen at a glance that it is absolutely impossible for it to become unsyphoned. The trap consists of a small air-tight chamber, A (*vide* description already given).

A branch pipe, E, is led from outside the house into the soil-pipe a little above the trap for the admission of fresh air, in order to admit, by the action of the patent cowl fixed on the soil-pipe, carried above the roof, of a constant current of fresh air, being kept up night and day, and during all weathers, throughout the whole of the pipes within the house.

Mr. Banner demonstrates and proves conclusively that without such branch or inlet pipe for fresh air, no current *up* the pipes *can* take place, and he thus shows, according to the plan almost universally adopted hitherto, that all the pipes within the house do and must remain always fully charged with dangerous gases, even though the soil-pipe be carried above the roof and be open, or what has hitherto been improperly called "ventilated" at the top. *We may add that this inlet pipe is a most important and distinctive part of Mr. Banner's system, and forms part of his patent rights.*

The efficiency of the trap thus formed cannot be destroyed by either pressure or suction, and entirely prevents any gas from the sewer getting up into the house.

This excellent invention keeps up a constant ventilation of the shaft, in fact it makes it impossible for foul air to remain in the shaft for a single second. The very instant the foul air is generated it is sucked up by the action of the cowl.

It is noteworthy that while a mere breath of air passing through the cowl creates a sufficient suction action, that the wind in this country blows on an average from 10 to 12 miles an hour throughout the whole year, and that when it is said to be "still" the air is then even moving at the rate of $1\frac{1}{2}$ to 2 miles an hour.

We conclude by reiterating that we believe Mr. Banner's system of sanitation will make any house to which it is applied absolutely safe from the intrusion of sewer gas, or noxious odours of any description from the drains or closets.

BANNER'S SYSTEM OF SANITATION.

(From the *Metropolitan*, February 26th, 1876.)

"Pure air," says Mr. R. J. Halton, in one of his sanitary lectures, "is the most important of all health factors. When it is breathed freely, plentifully, and continually there are few diseases it will not enable the body to resist." Every medical man and sanitarian will admit the truth of this. Pure air will sometimes effect that which medicine attempts in vain, and when it is considered that 99 out of every 100 diseases are due to some impurity or other of the blood or secretions, it is evident that where fresh air can be obtained, medicine takes up an inferior position. As, however, pure air removes disease, so does foul air generate it. From the breathing of air vitiated by respiration spring phthisis and other pulmonary complaints as well as typhus. But respiration is not the only form of air vitiation. The effluvia from cesspools and sewage are responsible for nausea, vomiting, diarrhœa, and enteric fever. Much has been said of late as to whether the water-closet and sewer system has increased the illness and mortality from these complaints, but for the present we may safely assume that the gases generated by the decomposition of fæcal matter, whether in D traps or others, cesspools, soil-pipes, house drains, or sewers, are undoubtedly injurious to health; and it is self-evident that the only thing to be done is to prevent their accumulation by dissipating them as soon as formed, and to exclude them *in toto* from our houses. Many have been the attempts to effect this. Hitherto no sanitary authority has been able to adopt any method by which the thorough ventilation of sewers could be accomplished, and as regards the ventilation of soil-pipes in houses, and the exclusion of sewer gas therefrom, that was considered, till recently, impossible.

The public are tolerably well acquainted with the fact that Mr. E. G. Banner, who resides at Brighton, has introduced some inventions of his, *the object of which is to effect what has been described above as not previously accomplished.* We had the opportunity a few days ago of inspecting the ventilating and other apparatus in Mr. Banner's house, and spent several hours with that gentleman in inquiring into the practical and scientific details connected with them.

As a trial of the ventilating contrivances, Mr. Banner's house

is perhaps as good a specimen as could be desired. The trap in the basement acts perfectly, and thoroughly prevents the possibility of any gas passing from the sewer into the soil-pipe. In order to ventilate this pipe, it was carried up above the roof of the house. The next point was to provide means for drawing the air *upwards*—an apparently easy matter. An ordinary cowl would, it may be imagined, effect this whenever the wind blew by a kind of suction power. Here, however, lies the mistake that many people have made, for it is impossible to withdraw air out from the top of a tube which is closed at the bottom. Where such a plan has been found to answer in any degree, the place of the air so withdrawn has been supplied by other and fouler air from the sewers, which has forced a passage through some imperfectly-sealing trap below. The cowl invented by Mr. Banner is of peculiar construction. It consists externally of a funnel-shaped tube placed horizontally on the end of the elongated soil-pipe, and is kept with the wider end always facing the wind by an ordinary arrow. The wind, entering the larger end of the funnel, passes through this annular space, and in so doing creates a partial vacuum. By this means a circulation is kept up. The wind, which on an average blows from eight to twelve miles an hour, no sooner passes through the annular space than air is withdrawn from the soil-pipe, and *fresh* air is admitted at the bottom. In fact, there is a regular circulation; air is constantly being withdrawn, and constantly supplied. On the day of our visit there was scarcely a movement perceptible in the air, yet a simple experiment showed the circulation was going on. It is a peculiar merit of the contrivance that the passage of the air must be upward, not downward. We examined closely the condition of the air in the soil-pipe, and found it perfectly inodorous.

The principle thus applied to the ventilation of a soil-pipe Mr. Banner proposes to apply to sewers. By establishing at suitable places the patent cowls, with a corresponding inlet to each, a circulation will be established, rendering the air within a sewer as nearly pure as that without. It may be said that it will not be wise to let out sewer gas to be breathed by the community at large, but it must be remembered that it is the *confinement* of air in sewers which renders it impure. But by constantly passing fresh air through the sewers no such generation of gas can take place, and consequently houses can never be impregnated with it.

BANNER'S SYSTEM OF SANITATION.

By Major H. C. Seddon, R.E.

(From the *Architect*, January 15th, 1876.)

For the past few years there have been great advances towards remedying the evils to which the convenience of having water-closets inside our dwellings has chiefly given rise. Many have been the patents taken out for closets trapped in diverse ways, as well as for sewer traps, till at one time freedom from sewer gas was generally supposed to be in direct proportion to the number and ingenuity of the traps intervening between the sewer and its different connections with the interior of the house. Then, however, the dreadful truth was announced that sewer gas, under pressure, could, nay did, force its way through all water traps, and that the suction caused by the passage of sewage matter through the pipes frequently unsealed the best traps by drawing the water out of them. *Now, however, an entirely new method of dealing with our soil-pipes is being prominently brought before the notice of the public. This is known as the "Banner System,"* after the gentleman who originated it in his defence, and who worked out the details which form such important features in its practical application. *Mr. Banner tells us that immunity from sewer gas is not to be obtained by a multitude of traps, but rather by having but one trap.* At one fell swoop he does away with all the traps upon which we have hitherto relied for safety. *By means of a very ingenious trap of his own invention, fixed at the foot of the soil-pipe, he cuts off effectually all communication between the soil-pipe and the drain below.* This done, he induces a constant current of fresh air from the bottom to the top of the soil-pipe, by means of a patented wind-cowl, fixed at the top of the soil-pipe, above the roof of the house.

An accurate description of Mr. Banner's system, and of the peculiar construction of his trap and wind-cowl, appeared in the *Architect* of November 20 last, under the head of "Notes on Novelties," the details of which need not, therefore, be repeated here; and in a subsequent number I wrote a letter drawing attention to certain points which seemed to me to require very careful consideration before the plan could be safely advocated for general adoption. Seeing that there was much to be said in favour of the system, especially as regards the fresh-air inlet at the foot, and the extracting force at the top of the soil-

pipe, I was anxious to see, in the first place, whether I had correctly understood the description given in these columns, and next, whether any satisfactory answers could be given to the queries in which I endeavoured to point out where failure was likely to occur. I will pass over Mr. Banner's answer to my queries, which appeared in the *Architect* of December 11, except in so far as to state that I accepted his invitation to visit his house and judge for myself. I did so on the understanding that I was at liberty to write a full account of what I saw, and to give my opinions upon it, whatever those opinions might be. This is what I purpose now to do, first to give the result of my personal investigations into the working of the system, as exemplified in his house at Brighton, and afterwards to analyze its claims to supersede, in whole or in part, the most approved methods at present in use for removing sewage matter from dwelling-houses.

Mr. Banner's house has a good external appearance, but, being on a terrace, is only open to the air at the back and front. The reception-rooms are large, lofty, and well lighted, and the bed-rooms are of good size and height; in all there are seventeen rooms, besides the kitchen offices in the basement. The above is all that can be said in favour of the house, for, in my opinion, one worse constructed, so far as all accepted theories of sanitary arrangements are concerned, it would be difficult to find. The water-closets are placed in the very worst positions that could be selected. After passing through the entrance hall, you come upon the inner hall, with a well staircase lighted by a skylight near the roof. Off this hall is a water-closet, with another immediately above it on the second floor, both being in the centre of the house and next to the party wall of the adjoining house, where no fresh air or other than borrowed light can reach them. Mr. Banner, however, set to work seriously, mastered the details connected with his own troubles, first carried up the open soil-pipe above the roof of the house, and after many trials eventually *succeeded, and I say so on conviction, in constructing a trap which most effectually cuts off all chance of sewer gas finding its way into any part of the soil-pipes within the house. This* was a great point gained, and seems naturally to have *led up to the next step, namely, the outlet to the open air just above the patent trap at the foot of the soil-pipe.* This became a necessity, owing to the air driven down the soil-pipe by water descending from the closets above not being able to force the

patent trap as it would an ordinary syphon trap; the result being, that it had to escape through the closet pans, and other trapped passages, into the house. This apparent objection to the rigid barrier placed at the foot of the soil-pipe, no doubt suggested the idea of providing a free outlet below for the air forced down by the sewage matter in its descent. The soil-pipe running down the centre of the house being now open to the air both at top and bottom, and effectually cut off from the sewer, *the crowning point of Mr. Banner's system was attained by placing a patent wind-cowl on the top.* The cowl is so constructed that the wind passing through it produces a constant draught up the soil-pipe, drawing fresh air from the garden level below, and through any untrapped inlets in the house, and so setting up a continuous counter-current in opposition to any tendency of the fires, &c., in the house to draw supplies of air through the house connections with the soil-pipe. The extracting power of the wind-cowl being once established, it became evident that the traps to the closets, sink, bath, and lavatory basin were no longer of any use, and, therefore, being mere obstructions and receptacles for sewage matter, were removed, leaving nothing but the patent trap at the foot of the soil-pipe to guard the way from the interior of the house and the sewer, except, of course, the water in the pans of the closets when not in the act of discharging.

Mr. Banner's patent trap, the working of which has already been described in these columns, occupies about the same space as an ordinary gas-metre, and is concealed from sight by a wood case in a recess in a cupboard, being fixed about 3 feet above the basement floor. About 6 feet above the trap are the closet and lavatory basin on the ground floor, about 30 feet higher are the upper closet and housemaid's sink, the bath being some 8 feet higher still, and the wastes from the bath and sink passing into the soil-pipe just below the closet on the second-floor, whilst that from the lavatory basin, on the ground-floor, discharges into the soil-pipe just below the lower closet. The top of the soil-pipe, upon which the extracting cowl is fixed, rises about 8 feet above the roof, and, being at the centre of the house, is not visible from the road. The communication with the outer air at the foot of the soil-pipe is formed by carrying a 2-inch pipe just above the trap, under the dining-room floor, to the garden in rear of the house. From the foot of the soil-pipe, which it is seen receives none of the refuse water from the kitchen, the

drain runs, as already stated, under the kitchen floor and through the area, with a very considerable fall, till it joins the main sewer in the middle of the road, the total distance being about 45 feet; only receiving on its way what passes through the surface traps in the open area, and the contents of the servants' closet under the street pavement, and discharging freely into the sewer without any intervening trap or flap-valve.

I will now describe what I saw of the practical working of the system in Mr. Banner's house, and of the tests to which it was put in my presence. Beginning at the highest point, namely, the patent cowl—which Mr. Banner informed me had been fixed for over a year, without once getting out of order—I first satisfied myself that it was performing its duty properly, veering with the wind, and drawing up air through the soil-pipe; this was evident from the strong current of air passing in through the mouth of the air-pipe, running from the garden to the foot of the soil-pipe, as well as from a perceptible indraught through the untrapped pipes from the lavatory basin and the closets. It was plain, moreover, that no air could be passing from the soil-pipe into the house. Passing down to the bottom of the soil-pipe, we next watched, through the glass plate which forms the front of the patent trap, the action of the cup valve within, while copious discharges were sent down the closets above. By means of a strip of glass inserted in the front of the soil-pipe, just above the top of the trap, the water could be seen rising in the foot of the soil-pipe, until it reached a height of about 12 inches, when the weight of the column of water being sufficient to overcome the resistance of the weight at the end of the lever arm, forced the valve down, discharging the contents of the pipe above into the drain below *without unsealing the cup*, which, directly the discharge ceased, leaving only the water retained in it when at its lowest point, closed up again with a slight deadened sound, against the indiarubber ring on the end of the soil-pipe. The air-tight joint upon which the weighted lever was fulcrumed was simply and carefully constructed, and can safely be relied on to prevent the passage of sewer gas. *The patent trap itself formed a perfect barrier against the passage of sewer gas from the drain into the soil-pipe above, and could not by any possibility be deprived by suction of the water which alone, when it is open, guards the way.*

In order to test the efficiency of the trap under extraordinary circumstances, we passed *down from the closet above some corks, hair,*

and a piece of an old curtain about the size of an ordinary duster. The piece of white curtain was seen to pass straight through the trap, which, however, did not close after it, though, of course, the water seal was maintained. *Hot water* was then discharged from the *upper closet*, whilst I stood by the outlet pipe in the garden, from which the air in the soil-pipe rushed with considerable force, but *without any disagreeable odour, that I could possibly detect*, though I fancied I perceived a very faint smell with the first rush which certainly would have been expected after treating with warm water the inside of a soil-pipe which had been more than twenty years in position, and which must necessarily be fouled by every discharge from a closet. *In order that we might examine into the state of the cup valve and the india-rubber ring against which it closes, the glass front to the trap was then removed. The cup itself was in perfect order, and free from any solid matter* beyond a slimy coating of lime, which the water deposits on all surfaces with which it comes in contact; *whilst the indiarubber ring appeared to be as sound as when first put on, more than two years* ago, owing, no doubt, to its constant immersion in water free from destructive agents, such as grease.

When the front of the trap had been replaced, I poured some strong scent *into the mouth of the air-pipe, leading from the garden to the soil-pipe*, in order to ascertain whether the air passing into the soil-pipe might not, at intervals of unequal action, find its way into the house, as well as out through the wind-cowl. *I was unable, however, to detect the odour of the scent in any part of the house, and must therefore conclude that the suction of the wind-cowl was at all times sufficient to overpower that of the house.*

The result of stopping up the mouth of the air-pipe leading from the garden was shown by discharging water from the pan of the upper closet, the effect on the lower closet being that the air in the soil-pipe—*finding it impossible to force the patent trap below* —in its efforts to escape, first raised the level of the water in the pan, and finally burst through, *sending the water flying in all directions.*

The same operation was then repeated, only with the lever of the patent trap raised, so as to put it in the condition of an ordinary water-sealed syphon; the result was that the air forced the trap without repeating the commotion in the pan of the lower closet. Finally, leaving unstopped the mouth of the air-pipe, and removing the plug of the lavatory basin on the ground

floor, water was again discharged through the upper closet, in order to see whether, under such circumstances, air could be forced into the house through the waste-pipe from the basin. Such, however, was not the case, but there was rather a suction through the waste into the soil-pipe.

This closes the account of my investigations into the practical working of Mr. Banner's system of sanitation, as far as I found it had been carried out in his own house. I have no hesitation in saying that *it worked admirably*, and that he has succeeded in rendering his house *absolutely secure against that most insidious of enemies*, "*sewer gas.*"

SEWER GAS.

(From *Public Health*, 8th April, 1875.)

Like many other of our engineering systems, that of the removal of excretal and refuse matter originated through accidental circumstances. The oldest sewer in the world, the *Cloaca maxima*, at Rome, was constructed for the drainage of part of that city. At a subsequent date, the inhabitants began, doubtless upon the principle of "out of sight, out of mind," to avail themselves of the ready means which this channel afforded them of getting rid of refuse matter, so that, by degrees, the monster drain became what its name implies—the main sewer, the *Cloaca maxima*, of Rome. From this second use to which it was put, the sewerage system now in use in most large towns may be said to have taken its rise.

Theoretically, the plan of removing refuse matter by water carriage has much to recommend it. The excretal matters are conveyed from the houses into the sewers, expeditiously and easily. So far, all seems well. But at this point, namely, the connection of the house-pipes with the sewer, we arrive at the first of the difficulties which surround the system, and which may render it injurious to health in the highest degree.

There are only two available modes of diminishing this evil—(1) by frequent flushing with water, so as to wash out the sewer, and (2) by ventilating the sewer, in order to prevent the accumulation of pent-up sewer gas. The former of these, even when large volumes of water are available for the purpose of

flushing, is too temporary and insufficient to be regarded as a positive means of removing the danger; and, at the best, can only be looked upon as an auxiliary measure. *Ventilation is the only certain remedy*, but, as it is *commonly* practised, it is *merely a delusion and a sham*. The ordinary street-grating ventilators are so constructed and so placed that, within forty-eight hours after they have been cleansed, they are again choked, and rendered impervious to the air from the sewers; and as, in the vast majority of instances, they are seen to only once now and then—it may be in several weeks, or several months—they are simply useless, or worse than that, owing to their engendering in the mind of the average British householder a feeling of safety, which has no foundation except in imagination.

Virtually, then, ventilation of the sewers is, in a great measure, carried on through the connections which exist between them and our houses. Sewer gas, like other volatile bodies, declines to be imprisoned in the place where it originated, and is constantly seeking for a weak point at which its exit may be effected. Such opportunities are unfortunately very abundant at the junction of the house-pipes with the sewers, and the inevitable consequence of defective joints or weak traps is the passage into the house of sewer emanations, which must, sooner or later, act prejudicially upon the health of the inmates. First, the children suffer; next the adults, especially those whose occupations keep them much within doors. Not only the air that they breathe is poisoned in this manner, but often also the water that they drink.

As we have already stated, the best general means of diminishing this danger is by free ventilation of the sewers. "*Ventilate, ventilate, ventilate!*"

There are very few towns where the sewers can be said to be *properly* ventilated, *and we must protect each house separately if we are to combat the difficulty effectually.* Sewer gas often plays an important part in the causation of various affections; and notably of typhoid fever, which although it is, in point of fact, a preventible disease, is credited with 20,000 deaths annually in the Registrar-General's returns, whilst, probably, 100,000 more persons (the mortality being 1 in 6) are laid upon a bed of sickness for many weeks, and their constitution undermined and enfeebled, by the same preventible disease which, were it not for the pollution of air or water by sewer gas or sewage matter, would scarcely ever occur.

Up to a recent period, we held the opinion that all drain-traps were apt to be inefficient or to get out of order, but opportunities that we have had of examining, at different times and under different general conditions, a system invented by Mr. E. G. Banner, have led to a modification of this opinion; and *we have further arrived at the conclusion* that *the inventor has solved the difficult problem of how to keep sewer gas out of our houses.* Mr. Banner's drain-trap was brought under the notice of our readers in *Public Health* of December 16th, 1874. The writer sums up the merits of this apparatus as follows: "It is self-acting, always air-tight, flushes clean, and cannot be unsyphoned."

In this manner the house will always be effectually trapped against sewer gas; and we are able to dispense with D traps, which, from their conformation, are, in point of fact, miniature cesspools, and with other unreliable contrivances. One of Banner's traps at the basement of the house, which may be placed above the level of the basement, like a gas meter, is sufficient for all the closets in a house.

In connection with the question of sewer gas we must not omit to mention another valuable appliance devised by Mr. Banner. Every one knows that ventilating *shafts* communicating with the soil-pipes are recommended by leading authorities upon the subject. Although the theory upon which they are constructed is good, they are not always of practicable utility. *There is a difficulty in getting sewer gas to ascend a long perpendicular pipe, while in some conditions of the atmosphere there may be a down draught instead of an upward current.*

Mr. Banner obviates these drawbacks, and at the same time insures a constant *upward* current, by placing at the top of the ventilating shaft a cowl, so delicately balanced, that the least breath of air creates a suction power which draws the air out of the ventilating shaft into the atmosphere. These cowls can be used anywhere, *and are a necessary adjunct to shafts, ventilating soil-pipes, &c.* The benefit that would result to the community from their general adoption cannot be over-estimated, as each would contribute to the ventilation of the sewers as well as of the pipes of the houses where they were fixed.

On one occasion of our seeing the apparatus at the inventor's house, where they have been in operation for more than twelve months, there were present a number of gentlemen interested in

sanitary matters, including several Medical Officers of Health for large and important districts. The apparatus received the highest commendation of all present, whose favourable judgment fully confirmed the opinion at which we had previously arrived.

BANNER'S SANITARY APPLIANCES.

(From the *Building News*.)

SIR,—It seems to me rather useless to discuss this matter with Mr. Buchan, as he acknowledges he has not seen nor endeavoured to prove Mr. Banner's appliances, and I have done both the one and the other; and I should not have replied to his letter in your last on that ground, but that others might imagine that the objections he has brought forward theoretically alone have some weight in disparaging a system which I consider has conferred a practical boon upon the public.

Mr. Banner has shown how pipes can be instantly emptied, and kept empty of all gases, and has thereby done good. If, instead of the term "sewer gas," I had said "sewage gas," it might have been better, and I should have been in order when remarking upon those foul gases which are generated in branch drains as well as in sewers. But when Mr. Buchan comes to speak of what he calls the heart of the system, and goes on to say that it is not new, but has been tried before and failed, I say he knows nothing of what he has taken no trouble to examine, and jumps at erroneous conclusions. *It is no wonder that the attempts which he described came to grief for want of the very extracting power of the cowl which he ignores. This power is not only a matter of theory, but has proved perfectly successful in practice.*

Mr. Buchan himself acknowledges the correctness *of the key-note of Mr. Banner's system*—namely, the ventilation of the bottom as well as the top of the soil-pipe, but prefers to do without the patent cowl and trap. *If the cowl be omitted, then traps become necessary to all the pipes, as he says.* But Mr.

Banner has shown us *that the latter are needless if the former be provided.* Feeling sure that Mr. Buchan only wishes, with myself, to find out and support what is really useful, I would advise him to go and see Mr. Banner's appliances before he writes any more in opposition to them, in order to air his own theories, and I certainly shall not answer him again till he does. I have already said that I think that much of what Mr. Banner has effected might be done more simply,* but this is, however, mere theory, for I have not done it, and, until some one does, householders cannot do ill in making use of a system which is neither costly nor elaborate, and *which does thoroughly effect what it proposes—namely, to render houses wholesome which are now mere deadly fever-traps, whether they be mansions in Belgravia or cottages in the suburbs.*

I am, &c.,

JOHN P. SEDDON.

1, Queen Anne's Gate, Westminster,
January 26, 1876.

(From the *Architect*, 8th April, 1876.)

"SIR,—I desire to add my testimony to the perfection of a system which has been rightly and pithily described as being '*at once so simple, yet so effective.*' I have heard scores of other sound practical men make similar remarks. Indeed, I might again quote the language of the author of 'Paradise Lost,' and say:—

> 'The invention all admir'd; and each how he
> To be th' inventor miss'd, so easy it seem'd
> Once found, which, yet unfound, most would have thought
> Impossible.'

"One of the best proofs of the value of a discovery is the amount of envy or imitation which it excites. It is really

* Not as long as the house-drain and sewers are allowed to remain in their present dangerous condition through want of proper ventilation.—E. G. B.

amusing to observe how one set of men will occupy themselves with detracting from the merits of any good thing which they did not themselves find out, while another set will deliberately assert that they knew all about it long before. Such is the present aspect of the case as regards Banner's system. There are numerous individuals who, not understanding its excellent points, depreciate them, and *there are other persons who, understanding them, coolly try to appropriate them.*

"I will close my letter by stating, in evidence of my being in a position to express an opinion upon Banner's system, that, from the date (December 15, 1874) when the first published account of it—appeared in *Public Health*, I have had the system under my notice, and that I have arrived at the conclusion that it accomplishes everything that is aimed at, and all that can be desired, by the absolutely certain manner in which it excludes sewer gas from houses.

"Your obedient servant,

"S.

"London, *April* 4, 1876."

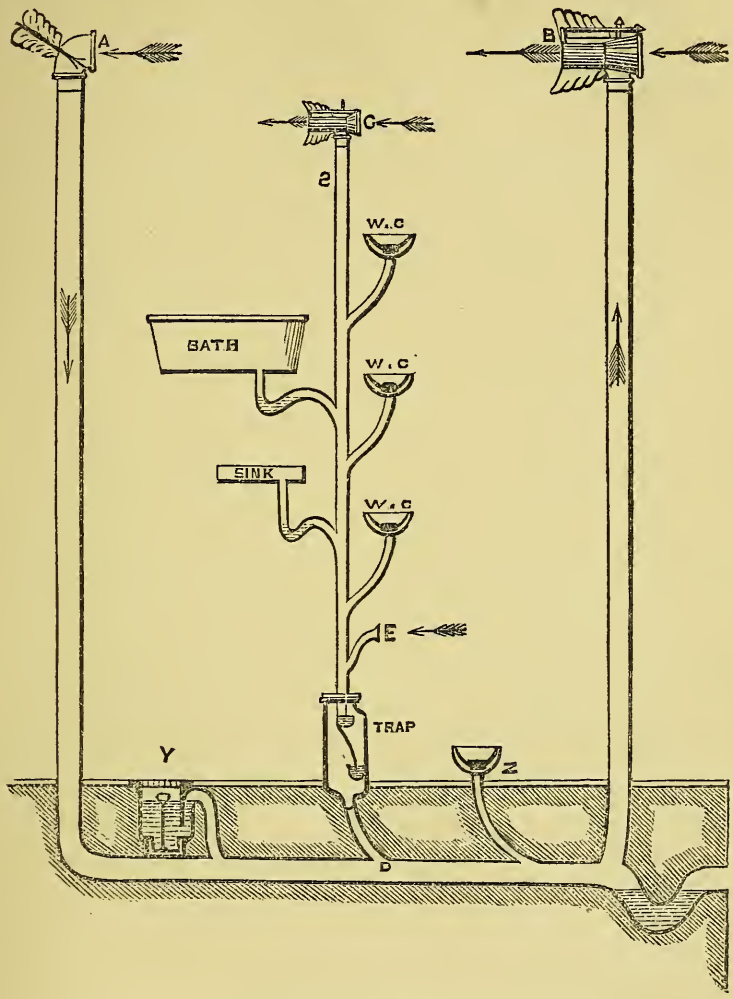
SANITARY IMPROVEMENTS AT THE HOSPITAL.

(From *Guy's Hospital Gazette*, January, 1877.)

We redeem a promise to our readers to give a more lengthened notice of the alterations made on the east side of the hospital, with the view of improving the sanitary condition of the surgical wards, and which were referred to in a previous number. We may as well premise, that, prior to the adoption of the "Banner system," much had been done to render the sewers in this division of the hospital more efficient, by the sub-

stitution of glazed earthenware pipes for the numerous brick-barrel drains which had been made to do duty for an indefinite period. These latter were found in many parts of their course to have suffered from decay and consequent leakage, mainly attributable to the energetic incursions of successive colonies of rats, which appear to have retained an undisputed possession of the stygian domains for upwards of a century, and, probably, as long as the hospital has existed. After securing a free current for the soil underground, to its point of junction with the Metropolitan sewers, it became a question of not less moment, how the escape of sewer gas into the wards and other residences was to be prevented; or, in other words, how the soil-pipes and minor conduits leading to the drains, as well as the drains themselves, were to be ventilated. Now, in nearly all private houses, and certainly in all public institutions, the reflux of sewer gas into the habitable apartments is restrained, or sought to be restrained, by means of valves or traps placed immediately under and continuous with the soil-pipe of the w.c., and the ingenuity of plumbers and of sanitary engineers has been taxed to the utmost to discover the best apparatus for this purpose. An infinite variety of syphons are consequently in use, each professing to impose a sealed barricade on the noxious intruder, but experience, of late years especially, has shown that, under certain conditions of the weather, both above and below ground, the supposed safeguards are not only valueless, but very often mischievous. It has also been repeatedly shown that the D trap, in such universal use, becomes in time so encrusted with deposits from the soil *as to prove a source of danger of itself*, independent of its faulty action. In what is unquestionably the best w.c. yet introduced—viz., Jennings' Patent Valve—in which the basin and trap are made in one piece of imperishable earthenware, and provision is made for continuous flushing, the inventor has thought it necessary to supplement the syphon action by a process for discharging a small quantity of disinfecting fluid into the pan every time it is used, mainly with the view of neutralising the pernicious effect of reflux sewer gas from the valve, but it is clear that in all these attempts at removing a nuisance we are beginning at the wrong end. What we wish to effect is, first, a free passage to the soil downwards; and, secondly, an equally free exit to the sewage gases upwards, and at the same time to render them perfectly innocuous by free admixture with the external atmo-

Plate 7.



A—Inlet to admission air shaft to drain.
B—Outlet to extraction shaft from drain.
D—Drain.
C—Outlet for air from soil-pipe.
E—Inlet for fresh air to soil-pipe.
S—Soil-pipe.
Y—Deane's trap.
Z—Pearson's trapless closet.

sphere. How this has been done at the hospital through Mr. Banner's intervention may be partially seen from the accompanying sketch intended to illustrate the manner in which the soil-pipes are ventilated, and also the means adopted for securing a free circulation of air in the drains.

The main object sought for is a continuous atmospheric current, which, when once obtained, must carry the mephitic nuisance, in a highly diluted form, free out of harm's way above the level of the roof. In the case of the soil-pipe, this is effected by the inlet pipe E at its base and by the foul air withdrawing cowl C which surmounts its upper extremity. The inlet pipe is placed immediately above the single trap which guards the communication betwixt the soil-pipe and the drain, and is fed continuously from the external air, while the cowl is so constructed as to exert at all times a considerable suction-force on the air in the pipe, and thus to maintain a current, variable with the wind's velocity, *but still permanent.* Nearly every one is familiar with the ventilating tube attached to the soil-pipe in private houses, so strongly recommended, and even insisted on by numerous sanitary authorities, to facilitate the escape of sewer gases. This air or safety-pipe is doing good service as far as its limited powers permit, but it cannot be too strongly borne in mind that the contrivance can only act intermittingly, and then only under certain fixed conditions. For the most part the air in soil-pipes and drains is stagnant, and *in this state* it is known to vitiate the water in traps, and unless counter openings are made, for the double purpose of admitting and withdrawing air, we have no security against the foul effects of deleterious gases, simply because we are deprived of the means of keeping up an atmospheric current. Again, to prevent any communication betwixt the drain and the soil-pipe, and thus nullify the action of the fresh air from the inlet tube, Mr. Banner has introduced a trap of peculiar construction, an illustration of which is given at Plate 5.

This trap is very simple and effective; it is cast in iron, and in the drawing the outer plate has been reversed so as to show its internal mechanism. One of these traps will suffice for any number of closets placed separately on floors above. There are two underneath the scullery projection of Accident ward, each doing service for four of the w.c.'s of the wards above, and since their introduction they have never been at any time unsyphoned. The trap has a double dip, and, while its depth is

only five inches, there is a vertical fall of two feet between the two dips, which would leave a space sufficient to contain a couple of gallons of water, exerting a downward force of over 20 lbs. on the lower dip, while the fall of water from the ward closets has been found amply sufficient to keep the upper dip free from any obstruction.

We have already referred to the wind cowl as the main *motive* agent for *maintaining* the continuous upward current. *That it does so effectually, by utilising the aspiratory force of the air, is beyond question; but it does more than this.* Its suction-force, though mainly employed in extracting the vertical column of air in the soil-pipe, is also imparted to the minor conduits connecting it with the numerous soil-pans, as has been repeatedly shown by the familiar experiment of holding a lighted taper over the pans to test the direction of the current. *From this circumstance Mr. Banner has felt justified in dispensing with the numerous traps, whether metallic or earthenware, attached to each closet, and has thereby got rid of a constant source of annoyance and expense, besides securing us an immunity from an ever-fruitful source of danger.*

The diagram also shows the manner in which the drain outside and running parallel with the hospital is ventilated. This drain is about 250 feet in length, and receives the soil and waste water from the wards and officers' houses on this side of the building. It is continuous throughout, that is to say, there are no syphon obstacles betwixt the various residences to interfere with the two soil currents which coalesce on account of the gradients near the centre, where they pass through a large earthenware syphon into the main sewer of the hospital. A free passage through the whole extent of the drain being thus obtained, its ventilation has been secured in the following manner:—At one extremity of the drain a down-cast shaft, A, has been introduced, surmounted with a wind cowl, with a cup-shaped orifice always exposed to the full force of the natural atmospheric current, and air being freely admitted from this source to the drain, the circuit is completed by an up-cast shaft at the other end, B, which is capped with a large foul air withdrawing cowl. Each shaft rises 10 feet above the roof of the hospital and is over 50 feet in height, so that we have here a channel of 350 feet in length, through which the air is made to traverse always in the same direction, a space dealt with, considering the number of houses and their numerous occupants,

equal in extent to the side of a square or division of a street, and from the drain to the large hospital sewer *there is but one outlet, which in its turn is guarded both at its entrance and at its point of junction* with the Metropolitan sewer by a similar apparatus. It may be noticed that the system of sewer ventilation here referred to is not dissimilar to that employed in coal mines or on board ships, and is the same in principle as that advocated by Desagulier, Reid, Peclet, and their numerous imitators, differing only (and the difference may be considered by many fatal to the theory) in the absence of an intermediate motive force to regulate the currents. *So far as our experience enables us to judge, the system appears to fulfil all the conditions specified in the contract. There is no foul air generated in the w.c.'s. The several currents in the soil-pipe, in the drain, and in the large sewer have uniformly been found to be flowing in the right direction whenever they have been tested* (*and this has been done repeatedly*), *while no inconvenience has arisen from the removal of the numerous traps and other apparatus which were thought to be the only safeguards of our closet system.*

It is very likely that exception may be taken to some of the principles on which this novel system of sanitation is based, and it is but right that it should be so. It may be open to question whether in a large city of varying levels, and among a dense population, it is preferable to have every house and drain evolving its noxious effluvia* into the outer abyss, to having it pent up underground and insidiously finding its way into habitable apartments, and from the notoriously eccentric character of atmospheric currents are we by any means assured that they will at all times follow the orthodox course; but these are matters that may be safely set aside for the present. It is sufficient for us to know that in this simple invention we have the means at our command of grappling with a great practical evil of ever-increasing dimensions, which has hitherto baffled the skill and ingenuity of architects and sanitarians, and the merit of the remedy is not the less commendable because it comes to us through the originality of a gentleman who, whatever his other accomplishments are, admits himself to be a mere novice in the art of sanitation.

* N.B.—As stated a few lines above, there is no foul air generated in the w.c.'s, *neither is there in the soil-pipe or the drain.*—E. G. B.

SANITATION AT GUY'S HOSPITAL.

(From the *Metropolitan*, December 16, 1876.)

In the early part of this year we took the opportunity of describing a method of ventilating soil-pipes introduced by Mr. E. G. Banner, of Billiter Square. It will be remembered that we paid a special visit to that gentleman's private residence at Brighton, where, having previously some vague notions of the theoretical part of the business, we had the advantage of learning some practical details by seeing the system in operation. We were thoroughly convinced of the efficacy of the plan, and described the action of the mechanical appliances used and the principles upon which they acted. There was no doubt about the matter. Mr. Banner's house was at one time almost uninhabitable by reason of the sewer gas which pervaded it, but ever since his system—born of the necessity for it which existed in the house—has been applied, the most perfect freedom from noxious effluvia has existed. Many scientific persons have inspected the house, and have done their best to find a flaw in the system, but those who arrived as sceptics went away convinced, some very much against their will. This was a great triumph so far, and we believe many other houses have been treated in a similar way with unvarying success. It is not to be wondered, therefore, if Mr. Banner desired to make more extensive experiments, so as to see if that *bête noir*, gas in sewers, could not be got rid of. Opportunity has not yet served for dealing with an entire system of sewerage, but a result has been recently achieved at Guy's Hospital which shows that, properly applied, Mr. Banner's system of sanitation is a great fact.

A short time ago we inspected the improvements effected by that gentleman in a large block of buildings forming part of the above hospital. We regret exceedingly that we did not view the premises before the alterations were made, so as to have compared the former with the present state of the building. At present there is not the slightest amount of effluvium in any of the wards, passages, or closets, but we have been assured that formerly sewer gas was the prevailing odour. The system of soil-pipes and drainage was upon the most unsanitary principle

imaginable. The drains were, and still are, in the worst possible position, and the soil-pipes were not even carried up to the upper part of the building, but were carefully sealed at the top, so as to encourage a rush of sewer gas into the closets and wards every time the closet-handle was drawn up. The interior of the pipes may be imagined, when it is said that some of them were 150 years old, well encrusted with hardened soil, fouling the already foul air within.

It would be difficult to convey, without the aid of diagrams, a complete idea of the alterations which have been made at the hospital. Our object is to explain the principles upon which the ventilation has been effected, rather than to describe minutely the mechanical details. We may say, however, that all the D traps in this part of the hospital have been removed, and each soil-pipe is virtually cut off from the drains by a Banner's patent double dip trap. The drains have but one delivery into the sewer, and the whole drain, several hundred feet in length, is ventilated by means of an inlet through an old grating and a vertical shaft at the opposite end with a patent cowl at the top. Another section of drains is ventilated by means of two shafts carried up to the top of the building, one having an inlet cowl, the other with a patent outlet cowl. Each soil-pipe is provided with an inlet pipe at the lower end, and a patent cowl at the upper.

The conclusions to be drawn from an examination of the improvements at Guy's Hospital are important. The principal is the fact that the system is practically shown to be applicable to a series of buildings as well as to single houses. The various departments of the block we have been referring to are, although not disconnected, virtually distinct buildings, so far as closets and soil-pipes are concerned. The frontage of the block, or rather the area drained, is equal to that of about forty ordinary houses, and it is no slight thing to thoroughly ventilate all the sewers and pipes connected with it by one process of treatment. Another point to note is the further confirmation of the soundness of the principles upon which Mr. Banner's system is based. It shows indisputably that a tube, whether it be straight or crooked, can be constantly ventilated by means of a continual current of pure air passing through it, providing there is an inlet at the lower end, and some kind of drawing or exhausting power at the upper. There must be these two conditions. An inlet without the drawing power, such as a properly constructed

cowl, amounts to nothing; and a cowl alone, without any inlet below, is perfectly inoperative. *It is amusing to notice how loth some sanitarians are to admit this self-evident fact.* They seem to believe that a tube may be ventilated by having both ends open, without any drawing power whatever. This might be, if elevated high above the ground, and fixed horizontally; but sewers, drain and soil-pipes, are not placed in such a position. Then, again, they argue that a sewer can be ventilated by inserting a long open vertical pipe at each end, and that by some natural law, which they do not explain, air will spontaneously rush down one tube, pass along the sewer, and ascend the other in the most obliging manner, without having any particular inducement to do so. Let such theorists simply take a tube bent into this shape—U, and apply smoke at one end, and see if the "natural law" they speak of will make it go down and up again. Place, however, an exhausting cowl on one orifice, and it will descend at once. This is the principle upon which the sewers are ventilated at Guy's, and no "*natural law*" *would cause air, as it now does, to go down a grating some* 12 *feet, traverse a drain* 300 *feet in length, where sewage is flowing in an opposite direction, and then ascend a pipe* 50 *feet or* 60 *feet in height. There must be an exhausting power, or no circulation can possibly take place.* That there is a constant current in the ventilating arrangement at Guy's Hospital we can testify. *The atmosphere at the time of our visit was dull, aqueous, and almost motionless, yet, by testing, we found there was a decided inward current at the inlets,* and we ascended to the topmost parapet of the building, and, *climbing to the orifice of the cowls, found there was an outward current containing only the faintest suspicion of odour. The system introduced by Mr. Banner has now undergone a crucial test, and can only be looked upon as a great* fait accompli.

ESCAPE OF SEWAGE GAS INTO HOUSES.

(From the *Journal of the Society of Arts*, June 29, 1877.)

The public are daily becoming more alive to the paramount importance of this subject, and, thanks to the efforts which the Society of Arts has lately been making, it may safely be said that increased progress is observable towards the end in view, by attention having been drawn to the grievous insecurity arising from the impure state of the drains and soil-pipes of houses, with a view of discovering the best modes of overcoming the difficulties of removing the dangers we are all thus exposed to.

The object of the Society of Arts, clearly, is not only to gather the latest and best information on the subject, but to disseminate it everywhere, by means of the powerful influence and through the excellent channels it is known to possess.

From the number alone of suggestions offered, a great deal of bewilderment must actually exist, and the difficulty is sometimes increased by a habit in some, who should fairly be looked to as guides, of straining the mind or the vision in search of very remote and merely possible difficulties—a habit which sometimes unwisely hinders activity, and by creating needless doubts, retards, and even prevents proper progress. The public, however, will as usual apply the winnowing process to the various suggestions offered, and will no doubt, as is their habit, in the long run, sooner or later, act upon the best.

Taking it as settled beyond dispute that it is imperatively necessary to exclude sewage gas and its fever-germ concomitants from dwelling-houses, with the Council's permission I will, as briefly as possible, show how such a most devoutly to be wished for consummation may be attained.

With all respect to Mr. Rogers Field, I must state that the plans he proposed, as illustrated by the diagrams exhibited at the Conference, not only do not satisfactorily accomplish that object, but, on the other hand, in some respects, have the reverse effect. Without repeating the criticisms of Drs. Vacher, Syson, and Ainley, and of Mr. Baldwin Latham, I will here only endorse those criticisms, and having described the system I

suggest, leave with all confidence the verdict to the intelligence of your readers.

The system I advocate as the most or only perfect system is that known to the world as the "Banner system." It consists of a trap inlet to soil-pipe and an exhaust cowl. The trap is fixed near the foot of the soil-pipe, whether it be inside or outside the wall of the house, or between the house and the sewer. This trap can never become unsyphoned, a liability of constant occurrence in suggested syphon traps; and another good feature in it is that its condition can be inspected at any moment without any trouble or expense. The inlet is an opening for fresh air to the soil-pipe a little above the trap. This inlet will be referred to later on. The next feature is the exhaust cowl. This cowl, unlike all other cowls, really produces a draught, and this draught, though varying according to the wind, is constant. Air, in the "Banner system," is constantly being drawn in at the inlet, and made to flow up the drain or soil-pipe, until it is discharged at the cowl outlet; or, if preferred, and a little more expense not objected to, the current may be brought down the soil-pipe, over the inner trap and out up an independent pipe, having the cowl fixed upon it above the roof: but in either case no sewage gas can remain in, or by any possibility enter the house. Another advantage of the system is, that all abominable D and other traps are avoided; in short, slightly paraphrased, the physician's motto is *par excellence* the Banner motto, "*Cito, jucunde, et tutissime.*" Being very simple, the system is economical. Without a cowl, an inlet is often worse than of no service; with no inlet, a cowl is of no service; with an ordinary cowl, no draught is insured; with the Banner cowl, the draught is perpetual. Mr. Banner claims to have been the very first to have introduced this safe and comparatively perfect system of efficient trap, inlet, cowl, and perpetual through draught. This being debated ground shall not be discussed. I will only say that I believe this system to be the only one which fulfils its purpose effectually, and that at the Conference no plan approaching it was brought forward, save when it itself was alluded to by speakers, in pointing out defects and shortcomings in plans proposed.

Since the late Conference, a report has been received from the surveyor of Guy's Hospital, where the system has been applied on a large scale, and, coming from such a source, I give a copy of it for the information of the Council of the Society of Arts:—

Guy's Hospital, *May 8th*, 1877.

Sir,—I regretted I had not an opportunity, when at the late Conference at the Society of Arts, to have entered into the discussion in reference to your system of sanitation, as carried out to a portion of "Guy's Hospital." I intended to have stated that, having had it in operation now for upwards of six months, I was perfectly satisfied with its results, both as to the patent traps as well as to your patent wind-cowls, neither one or the other having been found, after careful watching, to become unsyphoned or out of order.

I believe the action of your wind-cowls, placed upon the top of the soil-pipes, when coupled with the air inlet pipe, *as in your complete system*, to be quite effectual in maintaining a continuous upward current, not only through them, but also through the drains where they have been so arranged. And even more, their power of suction has been found, by repeated experiments of a lighted taper placed in the closet pans, to show the downward direction even of the current entering the soil-pipes.

You are, therefore, quite justified in dispensing with all D and other traps beneath each closet (which really are nothing better than cesspools on a small scale, proving always a constant source of annoyance and expense, as well as great danger, when retained): thus you are able to withdraw from the drains, as well as from the soil-pipes of the closets, sluice-pans, &c., of the different wards of the hospital where your system has been applied, during all winds and all weather, the foul air or gas from within them, and replace it entirely with a continuous current of fresh air. *I consider this fact alone to show the great blessing it must have conferred upon the inmates of the hospital, and believe it to be worthy of universal adoption.*—Yours faithfully,

(Signed) Arthur Billing,
Surveyor to the Hospital.

In conclusion, I will only add that the space and conditions dealt with at Guy's Hospital are equal to those of forty or fifty houses, and that the same system can readily be applied to the side of a street, or square, or to a crescent, or terrace of several

houses, whether the sewer be at the back or in front of them. One delivery for the whole of them into the sewer will suffice, while thorough ventilation and ample flushing power can be easily secured. The system is simple, consequently inexpensive. Excreta are never exposed for a moment, no sewage gas can be generated, and the only escape for impure air is above the roof of the houses.

R. Barnes Austin, C.E.

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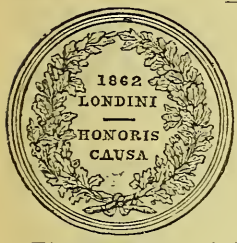

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